Kenya's Financial Transformation in the 21st Century

Edited by Amrik Heyer and Michael King

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FSD Kenya

5th floor, KMA Centre
Corner Chyulu/Mara Road
Upper Hill
P.O. Box 11353-00100
Nairobi
Kenya

Tel: +254 20 292 3000
Email: info@fsdkenya.org
Web: www.fsdkenya.org

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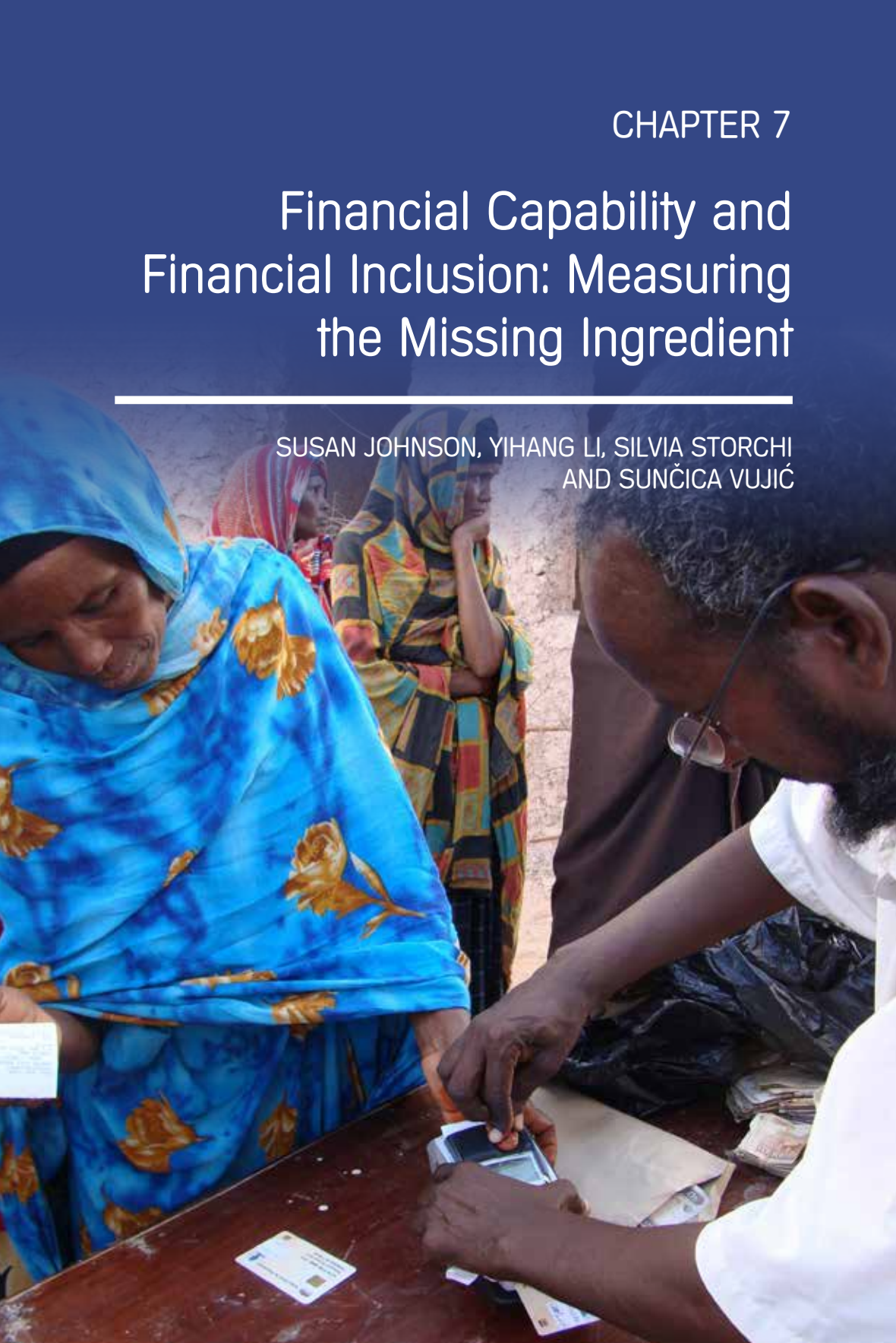
CHAPTER 7

Financial Capability and Financial Inclusion: Measuring the Missing Ingredient

SUSAN JOHNSON, YIHANG LI, SILVIA STORCHI AND SUNČICA VUJIĆ



1 Introduction

The last ten years has seen a huge rise in research into and analysis of the role of financial skills, knowledge and attitudes in financial decision-making and behaviours. This has been precipitated by different policy contexts – in the developed countries by the financial crisis, and in developing countries by the rise of the financial inclusion agenda (OECD, 2005) – and it has been furthered by the rise of behavioural economics (Thaler and Sunstein, 2009; Altman, 2012). The debate has evolved from a focus on the need for financial education to equip people with a knowledge and understanding of financial concepts and the operations of the financial sector ('financial literacy') and to enable people to interact with the sector, to recognising that the links between knowledge, attitudes and behaviours are as complex in this arena as they are in so many others (Kempson et al., 2005; Sherraden, 2010).[1]

The concept of 'financial capability' is now being used in developing country contexts with a view to understanding its role as a missing link to financial inclusion (Atkinson and Kempson, 2008; Accion, 2013; Kempson et al., 2013). While the measurement of financial literacy has focused on an understanding of financial concepts and interactions with the formal sector, studies in developing countries recognise that such knowledge may not be necessary for effective money management and more inductive approaches have identified a range of personal characteristics which respondents themselves identify as being related to *capability*. The most recent multi-country study, led by Elaine Kempson in collaboration with the World Bank (Kempson et al., 2013), identified ten domains that contribute to financial capability, but concluded that these could not be turned into a single measure because they were poorly correlated within countries and operated differently across country contexts. Moreover, measures of this type do not capture individuals' ability to manage their finances independently of endowments such as income, education or other attributes. An approach to measuring this ability is at present missing from the literature.

This chapter contributes to this discussion by conceptualising financial capability, from the perspective of Sen's capability approach (Sen, 1999), as the set of financial functionings that people have reason to value. It is then possible to consider the conversion efficiency with which individuals transform their knowledge, skills, attitudes and endowments into these desirable financial behaviours. Data envelopment analysis (DEA) can be used to measure the relative efficiency with which individuals transform their initial endowments

1 The experience of HIV/AIDS programmes, for example.

into financial functionings. This has the particular advantage of producing a measure which, by looking at efficiency, makes allowance for differences in education, income and proximity to services and does not require us to indicate which aspects of financial behaviours are more important than others. The efficiency measure is then developed and tested using data from FSD Kenya's FinAccess 2013 survey. Given the lack of respondents' own assessments of their financial functionings, we are constrained to making the assessment based on previously defined measures. A DEA measure of efficiency in achieving financially capable behaviour is produced, individuals are given relative scores, and the results are used to test the relationship between the DEA measure and access to key financial services using probit regression analysis.

Individuals' efficiency is found to be significantly related to the nature of their employment, and this is likely due to the way different patterns of income enable financial management. Additionally, participating in joint decision-making in the household, as opposed to being the sole decision-maker (including as a result of being single or divorced), is significantly related to the measure of efficiency, suggesting a role of relations with others in constructing efficient financial behaviour. Being Christian lowers efficiency relative to being of other religions. The measure is significantly positively related to the use of banks and Rotating Savings and Credit Associations (ROSCAs), but is not significantly related to the use of mobile money accounts. Causality is then tested using propensity score matching, with the results suggesting that it runs from banks and ROSCAs to greater efficiency rather than the other way.

We conclude that this presents a methodological innovation in the measurement and analysis of financially capable behaviours. However, the indicators available in the FinAccess 2013 survey are far from optimal. Ideally, the approach would focus on the ways respondents assess the extent to which they are meeting their financial goals, and in order to develop this approach further it is also necessary to compute comparable measures of inputs and outputs using the DEA across time. There is therefore a need for further consideration of measurement of the underlying variables.

The chapter proceeds as follows. First we present an overview of the evolution of the concept of financial capability and its measurement. DEA is then introduced and its application as a means of measuring the efficiency of achieving financially capable behaviour is explained. The data on which the measure is based is then described. The results are then presented and discussed in two stages: first, the efficiency score itself; and second, the analysis of its relationship to financial service access. We conclude with a discussion of the implications of our methodology and results for further research on financial capability.

2 Financial capability: An evolving concept in need of measurement

The measurement of financial literacy started out with questions to test understanding of compound interest rates, inflation and risk diversification in developed country contexts (Lusardi, 2008), and it has been found to be strongly associated with engagement with financial products and services such as retirement planning and investment choices. Even within these contexts, the definition of financial literacy lacks consensus (Huston, 2010; Remund, 2010), but it has mainly been associated with financial knowledge in order to address policy-related concerns regarding consumers' interaction with the financial sector that have risen over the last decade. As research has developed and, in particular, as evidence of the impact of financial education programmes has demonstrated relatively little impact of financial education on financial literacy itself (Mandell and Klein, 2009), the complexity of the relationship between knowledge and behaviour has also become more evident, which has brought about a shift to a wider conception of financial capability to capture this broader perspective.

Measures of financial literacy based on the understanding of financial concepts have been adapted and expanded to address developing country contexts (Cole et al., 2009; Carpena et al., 2011) in order to examine the relationship between knowledge and attitudes and behaviour towards financial services. While financial literacy is correlated to having a bank account in developing countries (Xu and Zia, 2012), its relationship with financial service use is more tenuous in a context where such use is low, and financial capability appears of greater relevance when embracing a wider conception of effective money and resource management.

Research in both developed and developing countries has shown that people talk about financial capability as comprising behaviours, attitudes, psychological traits and motivations (Kempson et al., 2005; Kempson et al., 2013), and this further demonstrates that the role of knowledge is not central in people's decision-making process. Financial capability has been found to be a composite of different skills covering areas such as day-to-day money management, planning for the future, choosing products and being informed (Atkinson et al., 2007). In their exploratory study, Kempson et al. (2005) found that knowledge and understanding, as well as skills and the personal characteristics of confidence and attitudes, affect individuals' levels of financial capability. The concept of financial capability thus appears to be multidimensional, both in terms of what behaviour it relates to and its determinants (Collins et al., 2009b;

FINRA, 2009). Indeed, the importance of individual personality, circumstances and previous experiences has also been recognised (Kempson et al., 2005), and this opens up a new level of discussion in which individual financial capability is seen in relation to the wider context in which an individual takes financial decisions, therefore suggesting that it is likely to be contextual and culturally sensitive (Atkinson and Kempson, 2008). This also makes clearer the potential for differences between being 'financially capable' in a developing country context and in a developed country context. Moreover, it also opens up the potential for financial capability to be fluid over people's life cycles (Kempson et al., 2005; Accion, 2013) and presents individual financial capability as a relative concept based on specific personal and contextual circumstances (Kempson et al., 2005). In line with this, some have argued against the view that financial capability constitutes a single capability that can be measured and that once gained, will directly impact people's financial decisions (Bay et al., 2014). The same authors talk about a 'situated model of financial literacy', which is dependent on the specific social and cultural setting, suggesting that capability is created through its practices and therefore it is through its practices that it should be approached and described (*ibid.*).

In contexts where formal financial access is very low, such as Kenya, financial capability has been found to be more strongly associated with individual efforts to increase household income and with individual virtuous behaviours (Zollmann and Collins, 2010). In these contexts – where income is low, irregular and unpredictable (Collins et al., 2009b) – financial capability is associated less with allocating funds into different investments and more with discipline and commitment. Efforts to increase financial capability may thus not actually result in improved financial inclusion, if financial illiteracy is not the biggest obstacle to financial access (Cole et al., 2009). Research in Kenya has shown that previous experience, both positive and negative, is a better predictor of take-up of financial services than financial education (Zollmann and Collins, 2010). Experience includes both personal use of certain financial instruments and observation of friends and family members. It seems that, in the Kenyan context, financial literacy is more important in avoiding being cheated by financial service providers than in being able to manage personal finances. Overall, in this context, the low uptake of financial services seems to be due more to the mismatch between the offer of and demand for financial services than to a lack of knowledge (Zollmann and Collins, 2010).

Atkinson and Kempson (2008) point out that in developing countries, surveys of financial capability should be both culturally and income neutral to capture people's real ability to manage their finances independently of their level of income or the role that they play in managing their money. In some households,

education levels or gender relations embedded in cultural structures and practices may define who the main money manager is. However, that individual may not be the most financially capable person in the household. According to Atkinson and Kempson (2008), it is therefore important to measure financial capability at the individual level, also taking into account those individuals who are not responsible for money management.

With this developing understanding, attempts to measure financial capability are still in their infancy. Two studies have used inductive approaches in an attempt to identify components of financial capability that are relevant across country contexts. Microfinance Opportunities (MFO) conducted research in India, Pakistan, Malawi and Costa Rica from which they developed an index for financial capability covering three areas: basic behaviours around money management (savings, spending, planning, borrowing, etc.), personal characteristics (prudence in spending money, ability to plan ahead, etc.), and relationships around money (e.g. being part of a reciprocal support network versus self-sufficiency) (MFO, 2015). This study confirmed the finding of Zollman and Collins (2010) that personal characteristics, such as being confident about individual management skills, being organised and being a good administrator, are key. In their identification of social relationships around money as inputs to financial capability, MFO included indicators about people's ability to build social capital in their communities (described as someone who helps others in the community), but also individuals' capacity to take care of their basic needs without external help. In addition, the index contains indicators on fairness and greed to evaluate the type of principles that drive individual financial management (MFO, 2015).

The most recent and extensive cross-country study undertaken is by Elaine Kempson and co-authors, in collaboration with the World Bank and with funds from the Russian Trust Fund (Kempson et al., 2013). The study started by using focus groups in eight countries (Colombia, Malawi, Mexico, Namibia, Papua New Guinea, Tanzania, Uruguay and Zambia) to establish what was understood by financial capability. Again, it was found to cover day-to-day management and planning for the future. Under day-to-day management, participants mostly mentioned the ability to plan against income and to stick to this, the ability to prioritise on essentials, being self-disciplined and living within one's means. Under planning for the future, participants described a financially capable individual as one who is able to think and plan for the future, to save and plan for unexpected as well as expected events, and someone who focuses on self-improvement and saves whenever possible. Personal characteristics such as altruism, control, time orientation, impulsivity, achievement orientation,

social status, and action orientation were used to distinguish between capable and incapable individuals (Kempson et al., 2013).

The dimensions of financial capability found in an earlier UK-based study (Kempson et al., 2005) related to choosing products and 'being informed' about them, but these were generally considered less important in developing countries, thus confirming the role of context. Also, participants did not relate financial capability to level of income or education, instead giving examples of financially capable individuals who were extremely poor and financially incapable people who were better off than the rest of the community. Financial capability was seen in terms of behaviour and as being highly connected to individual motivations (Kempson et al., 2013).

Kempson et al. (2013) also argue that other factors that need to be taken into account are the low level of education in developing countries and the geographical distribution of the population. A large portion of people in developing countries live in rural areas that are far from formal financial services and where a communal style of living is more widespread. The authors argue that it is more common for people to rely on each other for financial support and that financial decisions are often influenced by a communal interest, which is put before the individual's own. However, different practices of money management should not be taken *a priori* as a sign of not being financially capable, and should be evaluated in their particular context. Moreover, the authors argue that because of the low level of education, financial capability needs to be understood and evaluated using simple concepts to which people can easily relate, and that the core approaches to measuring literacy via compound interest rates and similar complex indicators are therefore not the best way to understand people's money management practices (Kempson et al., 2013).

From this work, they designed a survey which was then analysed using factor analysis to identify ten domains of financial capability: budgeting, living within means, monitoring expenses, using information, not overspending, covering unexpected expenses, savings, attitude toward the future, not being impulsive, and achievement orientation. These domains broadly correspond to the areas of financial capability identified in the first phase of the study, so the main goal of developing a measure of financial capability that is comparable across countries was achieved (Kempson et al., 2013). The study further tried to reduce the ten domains down to a single score. However, since the domains loaded on different factors in different countries, it was concluded that they would be more relevant to making comparisons across countries than a single score. This reiterates the fact that financial capability is a 'composite of skills' that may lose its meaning when reduced to one single score. Moreover, the

study points out that it is not possible to rank the ten domains of financial capability in order of importance and that comparisons between people can only be done at a domain level; it is not possible to say whether one individual is overall more financially capable than another (Kempson et al., 2013).

Above we have reviewed the evolution of the debate from a focus on financial literacy to financial capability in developing country contexts. Inductive research has now gone some way to identifying key domains through which financial capability is demonstrated and the influences on it. Moreover, in low-income contexts the use of actual financial services is no longer seen as constituting a key feature of financial capability. Kempson et al. (2013) argued that a single score could not be established because the relationship between factors differs too much across contexts, and concluded that an analysis of indices in different domains was therefore the best approach for the study. In the next section, we propose an alternative approach.

3 Methodology: Financial capability, the capability approach and conversion efficiency

The concept of financial capability seeks to capture the ability of an individual to achieve a set of desired outcomes in managing their money, taking into account the diverse contexts and circumstances they face. While the two have not been widely linked in the literature to date, this resonates with Sen's capability approach (Johnson and Storchi, forthcoming). The capability approach is an evaluative framework for examining well-being which distinguishes means from ends, as distinct from earlier welfare assessments that evaluated well-being through the space of income or utility. In Sen's view, money and resources are not the end but simply the means to achieving valued ends, which may differ between people. In this approach, people have a set of capabilities, or freedoms, which represent the opportunity to do or to be that which they have reason to value. The capability set is not observable because it is a set of possibilities. What is actually achieved is what Sen calls 'functionings', and these are observable as the final outcomes that people choose to achieve from their set of available capabilities.

Under this approach, the ability to effectively manage financial resources would also seemingly be better regarded as a means rather than an end, that is, as a set of skills that expand the capability set and hence change the achievements (functionings) that might be chosen. However, the boundary between capabilities and functionings is frequently blurred (Clark, 2005; Wolff

and De-Shalit, 2013) and some functionings, such as good health or basic education, are also inputs into further functionings, such as being able to work. These functionings have intrinsic value – for example, due to the status in society they can confer, hence contributing not only to material outcomes but also to social and subjective dimensions (White, 2010) – and they also deliver value in achieving further desirable functionings.

To date, the policy discussion around promoting financial capability suggests that the skills of being able to effectively manage money and resources are an important functioning for people to achieve, therefore appearing to treat financial capability as a functioning that people might have reason to value, perhaps as a means to further functionings. However, there is little evidence to date from open-ended research on well-being within this framework that such skills are valued, although resources frequently are (Johnson and Storchi, forthcoming). To fully operationalise this approach, it would be necessary to inductively establish relevant functionings and to adopt a methodology through which the extent to which they are achieved could be examined, for example through self assessment. In the absence of such data, we adopt the existing set of capacities identified in the previous studies discussed above as the set of desirable financial functionings. The capable outcomes are captured by financial behaviours such as budgeting, not overspending, living within one's means, saving, monitoring expenses and covering unexpected expenses.

The process of turning people's initial endowments of skills and resources into a set of functionings is called 'conversion'. In this process, endowments of income, education, and so on – along with personal characteristics, including psychology – feed into the establishment of the capability set and the choices made (Robeyns, 2005). The efficiency with which this conversion takes place is open to analysis. Binder and Broekel (2011) calculate the efficiency with which income is turned into subjectively assessed well-being outcomes using a version of data envelopment analysis. They then analyse the DEA scores to understand what might influence them in terms of age, gender, disability, and so on. Where some social groups seem to experience constraints in this conversion relative to others, this suggests avenues for the evaluation of public policy in achieving welfare outcomes.

Using this approach, we employ data envelopment analysis to measure conversion efficiency. DEA is a non-parametric method that uses linear programming techniques for the estimation of the relative technical efficiency of individuals as a set of decision-making units (DMUs) (e.g. firms, organisations or individuals) that produce a homogeneous set of outputs from a common set of inputs (Charnes et al., 1978). It is a powerful tool for dealing with multiple output and multiple input models, and it is especially useful when there is no

theoretical functional form of the production function being investigated. The approach has mainly been used to assess the efficiency of firms or organisations, including microfinance organisations (Gutiérrez-Nieto et al., 2007, 2009), but it has also been used in agricultural economics at the individual farmer level to assess decision-making (André et al., 2010) and farm sustainability (Reig-Martínez et al., 2011), to evaluate teacher effectiveness (Rogge, 2011) and to evaluate subjective well-being and life satisfaction (Bernini et al., 2013; Guardiola and Picazo-Tadeo, 2014).

DEA defines Θ as the ratio of the weighted sum of outputs to the weighted sum of inputs. The optimisation problem consists of finding the weights for the outputs and inputs that maximise the efficiency of the DMU i being analysed, under the restriction that using the weights, no-one's efficiency can exceed 1.

For each decision-making unit i, let $x_i^m (m = 1, 2, \ldots, M)$ be the M inputs used by DMU i and $y_i^n (n = 1, 2, \ldots, N)$ be the N outputs produced by DMU i. Let Θ_i denote the technical efficiency of DMU i, Θ_i is then given by :

$$\begin{aligned} \max \quad & \Theta_i = \frac{\sum_{n=1}^{N} U^n y_i^n}{\sum_{m=1}^{M} U^m x_i^m} \\ \text{s.t.} \quad & \frac{\sum_{n=1}^{N} U^n y_j^n}{\sum_{m=1}^{M} U^m x_j^m} \leq 1 \\ & U^n > 0, V^m > 0 \\ & \forall j, m, n \end{aligned} \tag{1}$$

In this study, the DMUs are the individuals who participated in the FinAccess 2013 survey in Kenya, the outputs are the financial behaviours which are indicators of financial functionings, and the inputs are the characteristics of the individuals which are hypothesised to have influence on the outcomes. DEA does have limitations. First, DEA results are very sensitive to the selection of the input and output variables. Thrall (1989) shows that the efficiency score produced by DEA cannot decrease when introducing new variables into the analysis. Therefore to avoid over-estimation of the DEA result, Banker et al. (1989) suggest that the number of DMUs should be at least three times the number of variables in the analysis. Since there are 5,198 DMUs in our study, which is much larger than in any other field of study using DEA, this problem has been addressed. Second, DEA using small samples of DMUs can also be confounded by the likelihood that DMUs that are more efficient than those in the sample have been omitted. Again, given the large number of DMUs in our case, this is unlikely to be an issue.

This approach offers a number of advantages that address the issues raised in the above literature review. First, it does not require us to indicate which aspects of financial behaviour are more important than others. Second, it produces a relative assessment across individuals with the potential to change over time. Third, individuals' endowments in terms of income, education, proximity to financial services and psychological pre-dispositions are included as inputs. The measure is therefore able to account for these endowments and is neutral to their influence, as it is the efficiency with which their endowments are turned into desirable outcomes that we now evaluate. An individual with a lower level of income or education or greater distance from financial services who achieves the same scores on output domains as someone with higher income or education or greater proximity to services, and lesser inclination towards the future, will be treated as a more financially efficient individual. Fourth, DEA is not sensitive to the unit and form of the variables, giving us flexibility in constructing the variables we need.

Finally, the approach can be applied across country contexts by pooling data and does not require a set of weights to be pre-defined through which a single index of efficiency of financial capability is produced. Hence, the result retains a richer relationship to the underlying data and can allow for relative cross-country comparisons of efficiency.

4 Data description

In order to develop input and output indicators with which to compute this measure of efficiency in achieving financial capability, we are constrained by the data available in the FinAccess 2013 dataset. This does not allow us to present indicators in all of the domains established by Kempson et al. (2013), so we have also used cluster analysis to develop indicators of inputs and outputs.

We extract seven indicators to be our output variables:

1. Having a budget (O1)
2. Sticking to a budget (O2)
3. Managing spending (O3)
4. Managing borrowing (O4)
5. Saving frequency (O5)
6. Variety of saving reasons (O6)

Cluster analysis[2] was used to form five of these indicators, namely 'Having a budget', 'Sticking to budget', 'Managing spending', 'Managing borrowing' and 'Variety of saving reasons'. The result of clustering shows that 'Having a budget' and 'Sticking to a budget' do not cluster together and thus need to be treated as distinct financial behaviours.

'Having a budget' comes from the statement 'You have a plan for how to allocate money for things like food, clothing, bills and other needs from month to month'. This is similar to one of the components of the budgeting domain constructed by Kempson et al. (2013), which asks 'whether people plan how to spend their money when they receive it, and how frequently they do it'. 'Sticking to a budget' comes from the statement 'No matter how hard you try, you just can't manage to stick to a budget'. We transform this variable so that those who disagreed with the statement get a higher value. Although this is also similar to one of the budgeting domains in Kempson et al. (2013) – 'How frequently they [people] keep to the plan they make' – we treat it differently because the cluster analysis shows that sticking to a budget is quite different to having a budget. Intuitively, there is no reason to expect that someone who has a budget will stick to it firmly.

'Managing spending' contains three statements: 'You often don't feel in control of your finances', 'You frequently borrow to buy things you want, but don't need to survive' and 'You often make spending mistakes that force your family to cut back on essentials, like food and cooking fuel'. These three statements cluster together and since they all represent the similar domain of overspending, we only treat those who disagreed with all three statements as not overspending.

'Managing borrowing' contains three statements: 'You need to take out additional loans to pay your existing credit/loans', 'You often have trouble making your money last between pay days' and 'You have often been surprised by the final amount you had to pay for a loan'. Since these statements covered different aspects of borrowing, we construct a variable that takes a value from 0 to 3 based on how many statements the individuals disagreed with.

On the saving side, we further consider people's frequency of saving in relation to a 365-day year, such that 1 represents daily saving, while saving twice a year scores 2/365, or 0.005. Kempson et al. (2013) construct their saving domain considering saving for the future and saving for emergency together with the regularity of saving. In contrast, we do not discriminate between different reasons for saving, or say which one is better. Instead, we use cluster analysis to

2 Results available on request.

group the saving reasons and treat those who can save for multiple reasons as being financially capable. From 23 reasons for saving, we identified four groups that characterise the four main categories of reasons that people are saving for: 'emergency and smooth consumption', 'long term', 'land and housing' and 'farming and other'. The variety of reasons for saving is constructed by counting how many categories the individual is currently saving for.

In selecting the output variables, we focus on how people really behave rather than how they think, and therefore exclude people's attitudes and awareness from the output side. There is always inconsistency between the thought process and behaviour, and behaviour is the output we are more interested in. On the other hand, we do not deny that there is a strong correlation between the two. If they do map each other perfectly, there will be no loss of generality when considering only one of them, and if not, then as stated above, we think behaviour is a more appropriate measure. Thus, we leave the psychological aspect to the input side.

There are numerous factors that can influence people's financial behaviour. Next to the psychological factors, the above discussion identifies formal education, financial literacy, income, and so on. We select the following variables as our inputs:

1. Attitude towards future (I1)
2. Attitude towards current status (I2)
3. Years of education (I3)
4. Income group (I4)
5. Financial numeracy (I5)
6. Financial literacy, including knowledge of financial terms – basic (I6), loan (I7) and investment (I8) – and financial institutions (I9)
7. Distance to the nearest financial service (I10)
8. Cost to the nearest financial service (I11)

The FinAccess 2013 dataset contains few psychometric variables. We use the statements 'You are worried that you won't have enough money to live on in old age' and 'You go without basic things so that you can save' to account for individuals' confidence about the future and saving, respectively. 'Years of education' and 'income' are chosen as input variables since they are highly correlated with saving behaviour. 'Financial numeracy' is a variable that takes a value of 0, 1 or 2 depending on how many numerical questions on fractions and interest the individual answered correctly.

We also treat 'financial literacy' as an input. In this case, it is based on familiarity with a range of financial terms that are grouped into three areas as a result of cluster analysis: basic, loan and investment. Adding knowledge of financial institutions, we construct four variables counting how many terms/institutions they have heard of.

To measure 'distance to financial service', we use the time it takes people to travel to the nearest financial service. We transform this so that the less time it takes people to get to the nearest financial service, the higher the value of the constructed variable. The same rule applies to the variable 'cost to financial service', but we use the log of this variable, as its reciprocal was otherwise too small.

Although DEA is a non-parametric method that does not require the specification of a particular functional form, some basic assumptions still need to be made. First, constant returns to scale are assumed since the application is to individual data in which a size effect should not arise, in accordance with the CCR model (Charnes et al., 1978). Second, this application uses output-oriented DEA in which the inputs are fixed and the extent to which outputs can be increased is assessed. This is most appropriate for policy-oriented problems where the aims are to increase the outputs rather than reducing the inputs. Moreover, for this approach outputs should not be under the control of DMUs, which might seek to adjust them in order to gain higher scores (Banker and Morey, 1986). Since the individuals face no incentives to control their outputs, we do not face this problem here.

The FinAccess 2013 dataset includes 6,449 individuals. Those under 18 years of age are dropped since formal services such as banks and mobile money, which are the subject of our subsequent regressions, require individuals to be aged 18 or over to access them. Some observations are also dropped because of missing input or output data, giving a final sample size of 5,198.

Table A1 in the Appendix shows the summary statistics for the constructed outputs and inputs. The difference between 'having a budget' and 'sticking to a budget' is evidenced here, with 74.4% having a budget but only 36.9% reporting that they stick to it. The mean of 0.07 for saving indicates an average saving frequency of once every 25 days. The financial literacy indicators show that people are familiar with the terms included in the variable for basic knowledge – such as 'savings account', 'insurance', 'cheque', 'budget' and 'ATM card' – and, on average, people have heard of nearly six of the seven terms. On the other hand, clustered terms related more to loans ('collateral', 'mortgage' and 'inflation') have a low recognition rate of less than one.

It is worth noting that the relationship between outputs and inputs is similar to that which common sense would suggest. Table A2 in the Appendix reports the correlation between the outputs and inputs. It shows that the ability to stick to a budget and to manage spending and borrowing are highly correlated with the two attitudinal variables, while having a budget and saving behaviour are more closely related with initial endowments of education, income and financial literacy. There is a causality concern in using the DEA approach – it may be unclear whether it is the inputs (education, income) that make people more financially capable, or the other way around. Table A2 shows that the demographic variables of concern are only highly correlated with saving variables, while other financial behaviour are controlled by psychological variables only.

5 Estimation results: DEA as a measure of conversion efficiency

Figure 1 presents the distribution of the DEA scores and Table A3 gives the descriptive data. The mean score is 0.401 and the distribution shows that the scores are skewed towards the lower end, although 9.5% have a score of 1, representing perfectly efficient conversion.

Figure 1: Frequency histogram of DEA

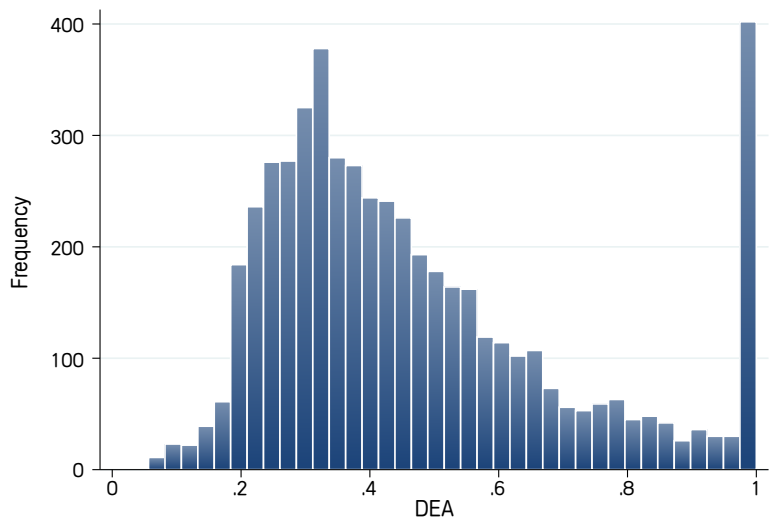


Table A4 presents the OLS regression result of the DEA efficiency score in its inputs and outputs. This analysis allows us to see, on average, how each input and output variable contributes to the DEA score. It shows basically that the coefficients of the inputs variables are negative and the outputs are positive, which is in accordance with how the DEA scores are computed. There is a counter-intuitive result for 'loan knowledge' that has arisen because of the high correlation within the knowledge variables. However, it is not appropriate to arbitrarily drop any one area of financial knowledge that has been established through the cluster analysis, and this simply demonstrates the behaviour of our score and does not actually affect the use of the variable in subsequent analysis.

Table A5 shows the OLS regression result of DEA on other social variables. Education, income and remoteness are elements of the input in DEA, so it is not surprising that they have a significant negative relationship with DEA. This result arises from the method of constructing the DEA score so does not offer new insight, but it is still necessary to include the variables as the regression results for other variables may otherwise be biased. In other words, the estimation of coefficients on variables that are correlated with education, income or remoteness might be influenced by the negative effect of inputs on DEA if education, income and rural were not included in the regression.

Apart from variables that are directly related to the input variables (rural – related to cost and distance to financial services, education and log of income), a number of other variables are also notable or significant. First, age has a very weak significant effect, suggesting some reduction in efficiency as people get older. Second, there are regional variations – those in the Eastern and Nyanza regions are significantly more efficient than those in Nairobi (the base case). Regional DEA averages show that Nairobi has the lowest average score, and this is in part due to the higher input variables in this region in terms of incomes, education and proximity to financial services. The relative advantage of Nairobians means that they would need to score higher in their output variables than those in other regions to attain similar efficiency scores, but it might be suggested that with such higher levels of income, in particular, they in fact do not need to be as efficient. In other words, there is an income threshold at which it becomes in some ways not necessary to be as efficient, since managing money is not as pressing. Further analysis of the DEA by income quartile[3] shows that the income effect does drop out in the top two quartiles of the income distribution, and that the regional effects virtually disappear.

3 Results available on request.

Third, being employed in the agriculture sector or doing business has a positive influence on efficiency capability (relative to being employed in own agriculture), and so does working for the government to a lesser degree. For those employed in agriculture, this may be the result of being paid a daily wage, which means that managing spending and sticking to a budget is a necessary and perhaps easier function. The direction of causality for those in business would seem likely to run both ways – those with greater efficiency in achieving capable behaviours are more likely to be in business because they are better at managing money; on the other hand, having a business also tends to yield daily income, which imposes a daily constraint on financial management. Being employed in government offers some significant associations, and this may also be because monthly salary receipts offer a framework within which financial management takes place. Interestingly, the effect of being employed in domestic chores is mildly negative, which is likely linked to the fact that this group is unlikely to have much in the way of financial management responsibilities through which their efficiency can be developed.

Fourth, being Christian is weakly related to lower efficiency scores, and this may be related to particular practices of money management in minority non-Christian populations (mainly Muslim). Fifth, the marginal significance of sole decision-making responsibility and the more significant result for shared decision-making in both specifications (2) and (3) supports the finding of Kempson et al. (2013) that those with responsibility for decision-making in the household are likely to be more financially capable, but also suggests that sharing decisions may produce a dynamic of discussion that positively moderates behaviour. This is consistent with the negative and significant result of being single or divorced.

Overall, these results offer insights into the distribution of the efficiency with which financial behaviours that are viewed as capable are achieved across Kenya, and the possible dynamics of achieving more efficient and capable financial behaviour. In particular, two areas stand out. The first is the relationship with employment type and what this means in terms of how different types of employment enable different types of financial management. The second is the role of shared household decision-making and the contrast with being a sole decision-maker (including as a result of being single or divorced).

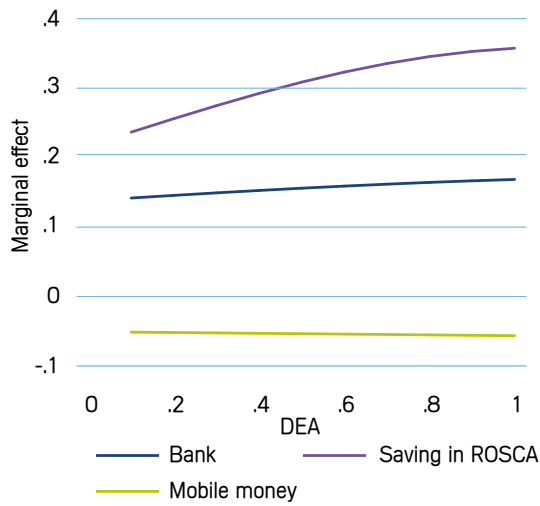
6 Estimation results: The role of financial capability in financial inclusion

In this section, we examine the relationship between the DEA measure of efficiency in achieving financially capable behaviour and access to the three most used financial services in Kenya: mobile money (66.4%), banks (31.8%) and ROSCAs (25.6%) (see Table A3 in the Appendix for summary statistics).

Table A6 presents the marginal effects for bank access across a range of specifications, and demonstrates that the DEA is positive and significant across all specifications. The results for ROSCAs (Table A7) are similarly positive and significant. The results for mobile money (Table A8), in contrast, show that the DEA efficiency score is not significant once other variables are controlled for.

These results are summarised in Figure 2, which shows the marginal effects of higher efficiency scores on access to each of these services (holding all other variables at their mean values). This presents a rather interesting relationship in which the strongest and most positive relationship is with ROSCA access, while that for bank access is much weaker and that for mobile money is slightly negative and declining. This result is not causal, as the effect of efficient behaviour on ROSCA use can run in both directions. Those who are more efficient are more likely to select themselves into ROSCAs, but, on the other hand, as the likelihood of membership of a ROSCA rises for other reasons, greater efficiency is achieved through the discipline that it offers.

Figure 2: Marginal effect of financial capability on access



The weaker positive relationship between rising efficiency in achieving capable behaviours and bank access resonates with the fact that banks provide less in the way of mechanisms that enable improved financial behaviour, especially in terms of discipline. This is underpinned by the fact that their use is strongly related to employment in the private sector and in government, where salaries are usually received through banks and using them is therefore not necessarily a choice in the pursuit of improved financial behaviour. In the reverse direction of causality, the relationship suggests that those with higher capability scores are more likely to use banks.

A negative relationship between mobile money use and efficiency could be interpreted as suggesting that the ease that mobile money offers in terms of accessing reciprocal transfers is either a cause or an effect – or both – of lower efficiency in achieving financially capable behaviours. In other words, those who are least efficient are more likely to seek access to transfers from others because they have not learnt how to manage shocks and hazards through their own financial management, while at the same time access to mobile money and the reliance on transfers it precipitates might in fact reduce the need to develop those behaviours. However, the negative coefficient is only marginally significant in one specification and therefore does not suggest that such dynamics are at play. Mobile money is a tool that has become widely used and other research has indicated that this bears little relationship to intentions to save or access to formal financial services, but that it facilitates the wide range of inter-personal transfers that are embedded in networks of reciprocity and a 'fiduciary culture' in which relationships of equality and 'negotiability' dominate (Johnson et al., 2012).

For the purposes of robustness testing, Table A9 shows probit estimation results using the separate input and output variables that constitute the DEA score. This shows that only the saving variables have independent relationships to service access.[4] The ability to save and diversity of reasons for saving are positively related to having a bank account but, interestingly, are negatively related to saving frequency. This supports the idea that people save in banks irregularly when they have money to do so, and contrasts with the built-in discipline in ROSCAs, which would appear to have slight positive effects. Use of all three services is only weakly positively related to the diversity of reasons for savings.

These results demonstrate that there is a significant relationship between efficiency scores and the use of banks and ROSCAs, which deserves further

4 The variable 'able to save' is omitted from the ROSCA regression because not saving is a perfect predictor of not being in a ROSCA.

examination to establish the direction of causality. In the next section, we therefore employ the methodology of propensity score matching to examine this.

7 Estimating the causal effect of financial service usage using the matching approach

An evaluation of the effects of programme participation – in this case, financial service use – has to deal with the problem of quantifying the effect of participation compared to what would have been the case without participating. This problem naturally arises because it is impossible to observe individuals in two different states (participation and non-participation) at the same time and place. Therefore, it is the principle task of any evaluation study to find a credible estimate for the counter-factual state.

There are essentially two methods to estimate the counterfactual situation: randomised experiments and non-experimental (also called *quasi-experimental*) methods. In principle, randomised experiments provide the easiest solution to recovering the desired counterfactual. In randomised experiments, individuals eligible for participation are randomly assigned to a treatment and control groups. Since these groups do not differ from each other, on average, in either observable or unobservable characteristics, and the control group can be considered 'identical' to the treatment group, the average difference in outcomes between the two groups provides a simple answer to the counterfactual question.[5]

Currently, the most common technique to solve the evaluation problem when the participants and non-participants are not randomly assigned to a programme is the *propensity score matching* (PSM) approach. This approach mimics a randomised experiment *ex post* by constructing a control group that resembles the treatment group as much as possible. After matching the members of the control group and considering their observable characteristics, they have a probability of being selected for participation in the programme that is comparable to that of the members of the treatment group. The key difference between this and the randomised approach, of course, is that unobservable characteristics cannot be controlled for.

5 Randomised experiments are often not politically or socially feasible. Moreover, they are in practice not entirely free of complications; see Heckman and Smith (1995) for a discussion of the advantages and disadvantages of the randomisation approach.

While the use of financial products (banks, ROSCA, or mobile money) has not been designed as a randomised experiment, the data for the evaluation analysis was constructed to mimic an experimental situation. For each member of the treatment group (i.e. financial service user), a matched partner with the same observable characteristics was drawn from the control group (i.e. financial service non-user). The intention was to create a control group that would resemble the treatment group as much as possible. The individual characteristics available for this matching procedure were education, income, religious origin, remoteness, gender, marital status, age, region, income resources, attitude to future and saving, and possession of a mobile phone. Table A10 shows the matching quality. After the matched pairs have been formed, a suitable way to assess the matching quality is a comparison of the standardized bias before matching, SB^b, to the standardised bias after matching, SB^a. The standardised biases are defined as

$$SB^b = \frac{(\bar{X}_1 - \bar{X}_0)}{\sqrt{0.5(V_1(X) - V_0(X))}}; \qquad SB^a = \frac{(\bar{X}_{1M} - \bar{X}_{0M})}{\sqrt{0.5(V_{1M}(X) - V_{0M}(X))}};$$

where $\bar{X}_1$ (V_1) is the mean (variance) in the treated group before matching and $\bar{X}_0$ (V_0) is the analogue for the comparison group. $\bar{X}_{1M}$ (V_{1M}) and $\bar{X}_{0M}$ (V_{0M}) are the corresponding values after matching (Rosenbaum and Rubin, 1985). Following the example of Sianesi (2004), we also re-estimate the propensity score on the matched sample to compute the pseudo-R^2s before and after matching. These measures (see Table 10) suggest that the quality of our matching procedures is quite satisfactory. The standardised bias of the matched sample is markedly smaller than that of the unmatched sample. Likewise, the pseudo-R^2 after matching are fairly low and decrease substantially compared to before matching. This is what we should expect considering that after matching, there should not be any systematic difference in the distribution of covariates between product users and matched product non-users.

If the matching approach is successful in mimicking a randomised experiment, any differences in observable characteristics between the treatment and control groups should disappear, which will then allow us to evaluate financial product usage by comparing mean outcomes between the treatment and control groups. Our point estimates in Table 11 suggest that bank usage is associated with a higher DEA, and this effect is statistically significantly different from zero – bank usage increases the DEA efficiency score by about 4.8 percentage points compared to non-bank usage. Similarly, ROSCA usage increases the DEA by about 7.0 percentage points compared to non-ROSCA usage. The difference in the effect of mobile money on the DEA between users and non-users is

not statistically different from zero, however. This leads to the conclusion that both using banks and using ROSCAs, but not mobile money, have a positive impact on efficiency in achieving financially capable behaviours.

This result is in some ways surprising, and the mechanism at work needs more exploration. ROSCAs clearly have a strong discipline component as part of their set up, and hence it might be expected that this would enhance saving and related financial management behaviours, but banks do not facilitate discipline as clearly. However, qualitative evidence from other research shows that putting funds in a bank account is seen as a way of moving funds from more immediate accessibility to somewhere that is further away and less easy to access, and hence aids discipline in the use of these funds. However, it is also possible that other unobservable factors in the form of underlying attitudes beyond those we have been able to match (attitude to saving, attitude to the future, etc.) are particularly important and that the PSM should also take these into account.

8 Conclusion

This chapter has presented an innovative approach to deriving a single measure to evaluate the efficiency with which people turn their endowments into financially capable behaviour, using data envelopment analysis (DEA). This approach takes forward recent research identifying domains of capability, while addressing the limitations of combining domains into a single index with fixed weights that may not adequately capture contextual variation. DEA acts to optimise the use of the data to derive the relative efficiency score, and hence allows for contextual variation in the absolute levels of inputs or the achievement of particular combinations of actual financial behaviours. Data can therefore be pooled across countries and comparisons made between them (as was done here for regions of Kenya), allowing a comparison of the relative efficiency of individuals in achieving different combinations of outputs dependent on their inputs.

The results indicate that type of employment is related to efficiency, which suggests that income flows of a certain nature – in particular, daily earnings – are likely to enable higher efficiency, and there is a weak but positive relationship with being employed by the government. Participating in shared decision-making has a positive effect and this, alongside the finding that being single or divorced has a negative effect (in contrast to being married), suggests that the dynamic of discussion within a household improves financial behaviour

outcomes. The financial practices of non-Christians are also correlated with enhanced efficiency.

Efficiency is positively and significantly related to the use of banks and ROSCAs, but negatively (though not significantly) related to the use of mobile money. Causality has been explored using the technique of propensity score matching, and the results suggest that this association is positively causal for banks and ROSCAs. Interestingly, mobile money has no similar effect, which confirms its role as a very different type of financial service.

Overall, these results suggest that ours is a meaningful measure of efficiency in achieving financial capability. However, the indicators available in FinAccess 2013 to undertake the analysis were rather limited in some areas (especially psychometric variables) and need to be further developed to enable further analysis of this type. More broadly, the conceptual framework of the capability approach deployed here offers the potential to take the analysis further. Instead of assessing the efficiency with which pre-defined indicators of financial capability are achieved, we may instead wish to assess the efficiency with which people are able to achieve the financial goals they value in pursuit of their well-being. Such an assessment requires difference indicators, and future FinAccess surveys should consider how this can be undertaken as it would offer a basis through which to assess both financial capability and the extent to which financial inclusion is actually meeting people's own objectives for well-being.

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Appendix

Table A1: Summary statistics of outputs and inputs

Variable	Mean	Std. Dev.	Min.	Max.
Have budget (O1)	0.744	0.437	0	1
Sticking to budget (O2)	0.369	0.482	0	1
Managing spending (O3)	0.311	0.463	0	1
Managing borrowing (O4)	1.769	1.081	0	3
Saving frequency (O5)	0.070	0.182	0	1
Variety of saving reasons (O6)	1.052	0.904	0	4
Attitude to future (I1)	0.300	0.458	0	1
Attitude to present (I2)	0.518	0.500	0	1
Year of education (I3)	7.759	4.136	0	16
Income group (I4)	3.012	1.612	0	8
Efficient numeracy (I5)	1.054	0.838	0	2
Knowledge: basic (I6)	5.873	1.927	0	7
Knowledge: loan (I7)	0.836	1.077	0	3
Knowledge: investment and risk (I8)	1.841	1.151	0	3
Knowledge: institution (I9)	3.452	2.025	0	7
Distance to financial service (I10)	3.713	3.797	0.143	12
Cost to financial service (I11)	-1.224	1.867	-6.215	0
Number of observations	**5,198**			

Table A2: Cross-correlations

	O1	O2	O3	O4	O5	O6	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	O11
O1	1.00																
O2	-0.15	1.00															
O3	-0.12	0.30	1.00														
O4	-0.14	0.28	0.31	1.00													
O5	0.05	-0.02	-0.01	-0.02	1.00												
O6	0.16	-0.08	-0.03	-0.07	0.22	1.00											
I1	-0.08	0.23	0.20	0.21	0.01	-0.06	1.00										
I2	-0.15	0.14	0.17	0.10	-0.02	-0.03	0.12	1.00									
I3	0.12	-0.01	0.05	-0.01	0.07	0.22	0.07	0.05	1.00								
I4	0.08	0.03	0.06	0.01	0.09	0.25	0.10	0.02	0.36	1.00							
I5	0.06	0.01	0.06	0.01	0.03	0.17	0.05	0.02	0.48	0.27	1.00						
I6	0.18	-0.05	0.01	-0.05	0.08	0.25	-0.01	-0.02	0.48	0.24	0.39	1.00					
I7	0.08	-0.02	0.03	-0.03	0.06	0.17	0.08	0.02	0.49	0.35	0.36	0.37	1.00				
I8	0.14	-0.03	0.02	-0.05	0.06	0.23	0.03	-0.02	0.52	0.32	0.43	0.65	0.58	1.00			
I9	0.15	-0.03	0.00	-0.04	0.10	0.22	0.04	-0.03	0.48	0.33	0.36	0.59	0.55	0.62	1.00		
I10	0.05	-0.00	-0.00	-0.03	0.06	0.06	0.07	0.01	0.22	0.19	0.15	0.13	0.22	0.18	0.18	1.00	
I11	0.09	-0.01	-0.01	-0.03	0.08	0.07	0.04	0.01	0.24	0.13	0.14	0.20	0.17	0.19	0.19	0.25	1.00

Note: Variable defninitions can be found in Table A1

Table A3: Summary statistics of probit regression variables

Variable	Mean	Std. Dev.	Min.	Max.	N
Product usage dummies					
Bank	0.318	0.466	0	1	5198
Saving in ROSCA	0.256	0.436	0	1	5198
Mobile money	0.664	0.472	0	1	5198
Financial capability efficiency score					
DEA	0.401	0.225	0.028	1	5198
Individual demographics					
Rural	0.618	0.486	0	1	5198
Female	0.588	0.492	0	1	5198
Single	0.207	0.405	0	1	5198
Divorced	0.026	0.158	0	1	5198
Widowed	0.095	0.293	0	1	5198
Age	36.907	14.631	18	97	4928
Age square	1576.138	1346.957	324	9409	4928
Primary education	0.507	0.5	0	1	5198
Secondary education	0.297	0.457	0	1	5198
Tertiary education	0.093	0.291	0	1	5198
Christian	0.939	0.240	0	1	5198
Log income	8.241	1.398	3.689	13.017	5198
Regional dummies					
Central	0.158	0.364	0	1	5198
Coast	0.092	0.29	0	1	5198
Eastern	0.168	0.374	0	1	5198
Nyanza	0.157	0.364	0	1	5198
Rift valley	0.237	0.425	0	1	5198
Western	0.109	0.312	0	1	5198
Income sources					
Income – transfer	0.471	0.499	0	1	5198
Income – employed in agriculture	0.228	0.419	0	1	5198
Income – domestic employment	0.07	0.255	0	1	5198
Income – government employment	0.039	0.193	0	1	5198
Income – employed in private sector	0.141	0.348	0	1	5198
Income – business	0.243	0.429	0	1	5198
Income – investment and other sources	0.047	0.211	0	1	5198
Asset					
Mobile	0.735	0.441	0	1	5198

Table A4: OLS regression results for inputs/outputs on DEA

Variable	DEA
Education year	-0.006***
	(-10.80)
Distance (transformed)	-0.009***
	(-20.14)
Cost to financial service (transformed)	-0.037***
	(-39.10)
Knowledge: Basic	-0.029***
	(-23.55)
Knowledge: Loan	0.009***
	(4.52)
Knowledge: Investment	-0.003
	(-1.46)
Knowledge: Institution	-0.006***
	(-5.05)
Efficient numeracy	-0.009***
	(-3.67)
Income group	-0.054***
	(-46.32)
Worrying about old age	-0.086***
	(-22.63)
Worrying without basic to save	-0.083***
	(-24.22)
Having budget	0.093***
	(23.74)
Stick to budget	0.013***
	(7.83)
Managing spending	0.056***
	(14.10)
Managing borrowing	0.068***
	(18.15)
Saving frequency	0.335***
	(35.80)
Saving variety	0.093***
	(46.83)
Constant	0.929***
	(117.14)
N	5,198
Adjust R^2	0.740

Notes: t-statistics in brackets. *, ** and *** represents significance level at 5%, 1% and 0.1% respectively.

Table A5: OLS estimation of DEA on social variables

	(1)	(2)	(3)
Rural	0.083***	0.086***	0.083***
	(12.66)	(13.10)	(12.69)
Age	-0.002*	-0.002*	-0.002*
	(-2.19)	(-2.10)	(-2.26)
Agesqr	0.000	0.000	0.000
	(1.87)	(1.85)	(1.91)
Education – primary	-0.150***	-0.154***	-0.151***
	(-14.49)	(-15.09)	(-14.61)
Education – secondary	-0.190***	-0.195***	-0.190***
	(-16.48)	(-17.28)	(-16.53)
Education – tertiary	-0.171***	-0.177***	-0.172***
	(-11.57)	(-12.17)	(-11.60)
Central	-0.017	-0.018	-0.017
	(-1.32)	(-1.42)	(-1.34)
Coast	0.017	0.014	0.016
	(1.21)	(1.02)	(1.14)
Eastern	0.033**	0.032*	0.033*
	(2.60)	(2.50)	(2.55)
Nyanza	0.035**	0.036**	0.034**
	(2.67)	(2.81)	(2.65)
Rift valley	0.022	0.019	0.020
	(1.80)	(1.56)	(1.68)
Western	-0.011	-0.011	-0.011
	(-0.79)	(-0.81)	(-0.80)
Income – transfers	0.009	0.011	0.010
	(1.59)	(1.84)	(1.72)
Income – employment in agriculture	0.024***	0.023**	0.024***
	(3.48)	(3.21)	(3.37)
Income – domestic employment	-0.024*	-0.024*	-0.022*
	(-2.18)	(-2.18)	(-1.96)
Income – government employment	0.041**	0.042**	0.041**
	(2.60)	(2.68)	(2.59)
Income – private-sector employment	-0.005	-0.007	-0.006
	(-0.55)	(-0.85)	(-0.72)
Income – own business	0.041***	0.041***	0.041***
	(6.03)	(6.03)	(6.04)
Income – investment and other	0.017	0.020	0.018
	(1.29)	(1.50)	(1.32)
Mobile	-0.012	-0.012	-0.012
	(-1.76)	(-1.79)	(-1.80)

Table A5 (continued)

	(1)	(2)	(3)
Log income	-0.059***	-0.059***	-0.059***
	(-24.62)	(-24.99)	(-24.85)
Christian	-0.058***	-0.055***	-0.056***
	(-4.57)	(-4.36)	(-4.48)
Gender			
Female	0.010	-	-
	(1.58)	-	-
Marital status			
Single	-0.021**	-	-0.016*
	(-2.85)	-	(-2.01)
Divorced	-0.047**	-	-0.043*
	(-2.64)	-	(-2.42)
Widowed	0.005	-	0.010
	(0.51)	-	-(1.00)
Decision-making role			
Sole decision-maker	-	0.025*	0.018
	-	(2.23)	(1.56)
Shared decision-maker	-	0.035**	0.027*
	-	(3.12)	(2.22)
Constant	1.128***	1.105***	1.119***
	(34.98)	(35.47)	(34.23)
N	4,928	4,928	4,928
Adj. R^2	0.329	0.329	0.330

Note: t-statistics in brackets. *, ** and *** represents significance level at 5%, 1% and 0.1% respectively.

Table A6: Marginal effects of probit estimation results on bank usage

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Education year	0.043***	0.030***	0.032***	0.031***	0.026***	0.022***	0.023***
	(33.24)	(21.43)	(22.26)	(20.13)	(16.31)	(13.57)	(13.95)
Log income		0.105***	0.114***	0.106***	0.085***	0.079***	0.077***
		(24.65)	(25.10)	(21.71)	(16.48)	(15.41)	(15.07)
DEA			0.149***	0.203***	0.185***	0.193***	0.190***
			(5.12)	(6.77)	(6.31)	(6.58)	(6.52)
Christian				0.005	0.011	0.007	-0.000
				(0.17)	(0.43)	(0.26)	(-0.01)
Rural				-0.068***	-0.042**	-0.035**	-0.032*
				(-5.11)	(-3.15)	(-2.69)	(-2.43)
Female				-0.045***	-0.035**	-0.031*	
				(-3.74)	(-2.93)	(-2.58)	
Single				-0.007	0.001	0.006	0.012
				(-0.48)	(0.09)	(0.40)	(0.80)
Divorced				-0.067	-0.050	-0.054	-0.068
				(-1.80)	(-1.39)	(-1.50)	(-1.91)
Widowed				0.033	0.033	0.034	0.007
				(1.46)	(1.50)	(1.54)	(0.31)
Age				0.009***	0.008***	0.006**	0.005*
				(4.40)	(3.89)	(3.16)	(2.46)
Age square				-0.000**	-0.000**	-0.000*	-0.000
				(-3.24)	(-2.85)	(-2.05)	(-1.46)
Central				0.044	0.069**	0.065**	0.060*
				(1.80)	(2.84)	(2.75)	(2.53)
Coast				-0.049	-0.035	-0.030	-0.033
				(-1.78)	(-1.30)	(-1.13)	(-1.25)
Eastern				-0.022	0.001	-0.000	-0.006
				(-0.90)	(0.03)	(-0.01)	(-0.25)
Nyanza				-0.068**	-0.053*	-0.047	-0.055*
				(-2.62)	(-2.07)	(-1.85)	(-2.18)
Rift valley				-0.057*	-0.039	-0.038	-0.043
				(-2.44)	(-1.68)	(-1.68)	(-1.92)
Western				-0.076**	-0.063*	-0.058*	-0.063*
				(-2.77)	(-2.36)	(-2.20)	(-2.39)
Income – transfers					-0.016	-0.016	-0.010
					(-1.36)	(-1.40)	(-0.87)
Income – employment in agriculture					-0.086***	-0.076***	-0.079***
					(-5.75)	(-5.12)	(-5.30)

Table A6 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Income – domestic employment					-0.043	-0.045	-0.043
					(-1.79)	(-1.90)	(-1.80)
Income – government employment					0.216***	0.208***	0.200***
					(6.19)	(6.11)	(5.89)
Income – private-sector employment					0.018***	0.101***	0.097***
					(6.71)	(6.41)	(6.19)
Income – own business					0.063***	0.051***	0.047***
					(4.80)	(3.97)	(3.61)
Income – investment and other					0.085**	0.082**	0.078**
					(3.12)	(3.05)	(2.94)
Mobile						0.166***	0.162***
						(10.60)	(10.36)
Sole decision-maker							0.100***
							(4.16)
Shared decision-maker							0.047
							(1.87)
N	5,198	5,198	5,198	4,928	4,928	4,928	4,928
pseudo R^2	0.126	0.207	0.211	0.236	0.262	0.28	0.284

Note: t-statistics in brackets. *, ** and *** represents significance level at 5%, 1% and 0.1% respectively.

Table A7: Marginal effects of probit estimation results on ROSCA usage

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Education year	0.005***	0.004*	0.008***	0.011***	0.012***	0.009***	0.008***
	(3.54)	(2.36)	(5.23)	(6.09)	(6.56)	(5.07)	(4.57)
Log income		0.013**	0.031***	0.048***	0.046***	0.043***	0.037***
		(2.71)	(6.27)	(9.36)	(8.60)	(8.03)	(6.84)
DEA			0.301***	0.293***	0.273***	0.281***	0.283***
			(10.37)	(9.90)	(9.23)	(9.51)	(9.52)
Christian				0.082**	0.080**	0.079**	0.102***
				(2.79)	(2.73)	(2.69)	(3.44)
Rural				-0.029*	-0.026	-0.023	-0.028
				(-2.09)	(-1.80)	(-1.63)	(-1.94)
Female				0.165***	0.152***	0.155***	
				(13.14)	(11.83)	(12.14)	
Single				-0.123***	-0.115***	-0.113***	-0.081***
				(-7.36)	(-6.90)	(-6.76)	(-4.58)
Divorced				-0.006	-0.011	-0.014	0.027
				(-0.15)	(-0.29)	(-0.36)	(0.71)
Widowed				0.009	0.018	0.018	0.090***
				(0.43)	(0.82)	(0.86)	(4.10)
Age				0.009***	0.009***	0.007***	0.007**
				(4.24)	(4.05)	(3.38)	(3.25)
Age square				-0.000***	-0.000***	-0.000***	-0.000***
				(-4.48)	(-4.13)	(-3.44)	(-3.63)
Central				0.047	0.044	0.039	0.045
				(1.73)	(1.64)	(1.48)	(1.68)
Coast				-0.020	-0.016	-0.014	-0.017
				(-0.64)	(-0.52)	(-0.45)	(-0.55)
Eastern				0.112***	0.109***	0.108***	0.111***
				(4.21)	(4.09)	(4.08)	(4.14)
Nyanza				0.137***	0.119***	0.123***	0.127***
				(5.09)	(4.39)	(4.57)	(4.68)
Rift valley				-0.029	-0.018	-0.017	-0.020
				(-1.12)	(-0.68)	(-0.68)	(-0.77)
Western				0.034	0.035	0.039	0.043
				(1.15)	(1.20)	(1.35)	(1.48)
Income – transfers					0.027*	0.025*	0.041***
					(2.22)	(2.05)	(3.31)
Income – employment in agriculture					0.060***	0.066***	0.061***
					(4.15)	(4.57)	(4.19)

Table A7 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Income – domestic employment					-0.006	-0.007	0.013
					(-0.23)	(-0.29)	(0.53)
Income – government employment					-0.098**	-0.098**	-0.094**
					(-3.01)	(-3.01)	(-2.90)
Income – private-sector employment					-0.016	-0.020	-0.040*
					(-0.83)	(-1.05)	(-2.09)
Income – own business					0.083***	0.075***	0.082***
					(6.06)	(5.50)	(6.01)
Income – investment and other					0.053*	0.055*	0.059*
					(2.00)	(2.10)	(2.21)
Mobile						0.100***	0.100***
						(6.65)	(6.54)
Sole decision-maker							0.099***
							(3.35)
Shared decision-maker							0.188***
							(6.27)
N	5,198	5,198	5,198	4,928	4,928	4,928	4,928
psuedo R^2	0.002	0.003	0.021	0.1	0.114	0.122	0.108

Note: *t*-statistics in brackets in brackets. *, ** and *** represents significance level at 5%, 1% and 0.1% respectively.

Table A8: Marginal effects of probit estimation results on mobile money usage

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Education year	0.040***	0.032***	0.031***	0.030***	0.028***	0.013***	0.013***
	(32.50)	(23.98)	(21.72)	(18.68)	(16.75)	(8.67)	(8.72)
Log income		0.068***	0.063***	0.057***	0.045***	0.023***	0.020***
		(15.63)	(13.48)	(11.18)	(8.44)	(5.12)	(4.55)
DEA			-0.067*	-0.034	-0.051	-0.042	-0.042
			(-2.36)	(-1.14)	(-1.71)	(-1.71)	(-1.71)
Christian				0.077**	0.079**	0.071**	0.072**
				(2.85)	(2.94)	(3.23)	(3.28)
Rural				-0.024	-0.002	0.020	0.021
				(-1.65)	(-0.16)	(1.67)	(1.74)
Female				0.000	0.001	0.020	
				(0.03)	(0.07)	(1.89)	
Single				-0.080***	-0.075***	-0.049***	-0.038**
				(-4.90)	(-4.61)	(-3.69)	(-2.67)
Divorced				0.028	0.025	0.023	0.020
				(0.70)	(0.65)	(0.70)	(0.62)
Widowed				0.007	0.012	0.015	0.014
				(0.34)	(0.53)	(0.81)	(0.75)
Age				0.014***	0.014***	0.007***	0.006***
				(6.91)	(6.63)	(4.02)	(3.48)
Age square				-0.000***	-0.000***	-0.000***	-0.000***
				(-7.14)	(-6.77)	(-4.02)	(-3.69)
Central				-0.026	-0.006	-0.014	-0.016
				(-0.83)	(-0.20)	(-0.55)	(-0.63)
Coast				-0.091**	-0.082*	-0.045	-0.050
				(-2.72)	(-2.44)	(-1.69)	(-1.88)
Eastern				-0.110***	-0.089**	-0.078**	-0.082***
				(-3.56)	(-2.86)	(-3.18)	(-3.31)
Nyanza				-0.088**	-0.082**	-0.038	-0.044
				(-2.83)	(-2.62)	(-1.53)	(-1.77)
Rift valley				-0.108***	-0.087**	-0.062**	-0.067**
				(-3.63)	(-2.90)	(-2.64)	(-2.84)
Western				-0.130***	-0.118***	-0.068**	-0.072**
				(-4.02)	(-3.63)	(-2.65)	(-2.78)
Income – transfers					0.010	0.004	0.013
					(0.83)	(0.43)	(1.30)
Income – employment in agriculture					-0.028	0.004	0.000
					(-1.95)	(0.31)	(0.04)

Table A8 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Income – domestic employment					0.002	-0.006	0.001
					(0.10)	(-0.33)	(0.03)
Income – government employment					0.118*	0.063	0.058
					(2.46)	(1.72)	(1.59)
Income – private-sector employment					0.117***	0.069***	0.063***
					(5.54)	(4.13)	(3.73)
Income – own business					0.100***	0.047***	0.046***
					(6.59)	(3.81)	(3.75)
Income – investment and other					-0.024	-0.025	-0.026
					(-0.75)	(-0.97)	(-1.01)
Mobile						0.394***	0.390***
						(53.79)	(52.99)
Sole decision-maker							0.074***
							(3.70)
Shared decision-maker							0.056**
							(2.70)
N	5,198	5,198	5,198	4,928	4,928	4,928	4,928
psuedo R^2	0.109	0.143	0.144	0.162	0.175	0.39	0.391

Note: t-statistics in brackets. *, ** and *** represents significance level at 5%, 1% and 0.1% respectively.

Table A9: Marginal effects of probit estimation using indicators of financially capable behaviour

	Bank	ROSCA	Mobile money
Rural	-0.029*	-0.008	0.014
	(-2.37)	(-0.60)	(1.15)
Female	-0.025*	0.156***	0.020
	(-2.17)	(12.75)	(1.88)
Single	0.007	-0.108***	-0.047***
	(0.46)	(-6.73)	(-3.55)
Divorced	-0.070*	-0.038	0.020
	(-2.03)	(-1.04)	(0.63)
Widowed	0.028	0.020	0.015
	(1.34)	(0.99)	(0.80)
Age	0.006**	0.006**	0.007***
	(2.88)	(2.91)	(4.00)
Agesqr	-0.000	-0.000**	-0.000***
	(-1.71)	(-2.93)	(-3.99)
Education year	0.017***	0.002	0.012***
	(10.73)	(1.33)	(8.61)
Central	0.032	0.008	-0.019
	(1.42)	(0.30)	(-0.75)
Coast	-0.018	0.009	-0.042
	(-0.68)	(0.31)	(-1.59)
Eastern	0.001	0.115***	-0.086***
	(0.05)	(4.56)	(-3.48)
Nyanza	-0.061*	0.099***	-0.046
	(-2.55)	(3.87)	(-1.84)
Riftvally	-0.036	-0.009	-0.062**
	(-1.66)	(-0.37)	(-2.63)
Western	-0.052*	0.049	-0.065*
	(-2.05)	(1.79)	(-2.53)
Income – transfers	-0.031**	0.008	-0.002
	(-2.84)	(0.73)	(-0.15)
Income – employment in agriculture	-0.078***	0.056***	0.001
	(-5.46)	(4.01)	(0.06)
Income – domestic employment	-0.046*	-0.021	-0.006
	(-2.05)	(-0.90)	(-0.31)
Income – government employment	0.169***	-0.115***	0.049
	(5.21)	(-3.79)	(1.34)

Table A9 (continued)

	Bank	ROSCA	Mobile money
Income – private-sector employment	0.078***	-0.042*	0.062***
	(5.13)	(-2.33)	(3.67)
Income – own business	0.030*	0.039**	0.039**
	(2.37)	(2.94)	(3.13)
Income – investment and other	0.061*	0.039	-0.033
	(2.44)	(1.56)	(-1.30)
Mobile	0.134***	0.068***	0.386***
	(8.86)	(4.69)	(52.28)
Log income	0.055***	0.015**	0.022***
	(11.56)	(2.97)	(5.33)
Christian	-0.019	0.043	0.069**
	(-0.77)	(1.54)	(3.14)
Having budget	0.025	0.029*	0.034**
	(1.91)	(2.12)	(2.97)
Sticking to budget	-0.002	-0.004	0.006
	(-0.20)	(-0.30)	(0.55)
Managing spending	0.027*	0.013	-0.007
	(2.22)	(1.01)	(-0.62)
Managing borrowing	-0.002	-0.006	0.005
	(-0.29)	(-1.11)	(0.98)
Saving frequency	-0.049	0.130***	-0.046
	(-1.75)	(4.72)	(-1.66)
Variety of saving reasons	0.118***	0.128***	0.030***
	(20.52)	(21.07)	(5.07)
Attitude to future	0.013	-0.027*	0.002
	(1.07)	(-2.04)	(0.21)
Attitude to saving	-0.005	0.003	0.003
	(-0.48)	(0.27)	(0.28)
N	4,928	4,928	4,928
psuedo R^2	0.335	0.189	0.395

Notes: *t*-statistics in brackets. *, ** and *** represents significance level at 5%, 1% and 0.1% respectively.

Table A10: Matching quality

Treated	Sample	Pseudo R^2	LR χ^2	p > χ^2	MeanBias	MedBias
Bank	Raw	0.274	1686.70	0.000	26.3	19.3
	Matched	0.013	55.62	0.001	4.4	3.4
ROSCA	Raw	0.109	613.20	0.000	14.3	13.2
	Matched	0.004	15.39	0.950	2.2	1.6
Mobile money	Raw	0.389	2440.81	0.000	25.0	15.2
	Matched	0.016	143.92	0.000	4.7	4.3

Table 11: PSM result

Outcome variable	Treatment variable	Treated	Controls	Difference	S.E.	t-stat
DEA	Bank	0.4121	0.3778	0.0344	0.01253	2.74
	ROSCA	0.5101	0 .4563	0.0537	0 .0109	4.91
	Mobile money	0.4341	0.4331	0 .0010	0.0160	0.06

The transformation of financial services in Kenya since 2000 has been remarkable. Kenya outperforms both the global average and many middle-income countries such as Chile, Brazil, India, Mexico and Russia, with 75% of adults holding a formal account that allows them to save, send or receive money. This book explores the transformation with analysis of a range of new datasets by leading academic experts. The exceptional growth in mobile money, the emergence of bank agents, the expansion of bank branches and the growth of domestically owned banks are just some of the dimensions investigated in the book. While the Kenyan experience is unique, the story has great relevance for all emerging economies seeking to develop their financial systems.

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5th floor, KMA Centre • Junction of Chyulu Road and Mara Road, Upper Hill • PO Box 11353, 00100 Nairobi, Kenya

T +254 (20) 2923000 • **C** +254 (724) 319706, (735) 319706

info@fsdkenya.org · www.fsdkenya.org

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